G. William Chapman IV

website: https://wchapman.github.io/

Summary

Upcoming PhD graduate in computational neuroscience, with an additional 6 years as a software developer and scientific analyst in research-oriented settings. As a scientific analyst I have specialized in temporally-aware analysis, with a strong emphasis on interacting with subject-experts. As an independent researcher, I have focused on novel neural network architectures to support prediction of spatiotemporal data.

EDUCATION

Boston University Doctor of Philosophy - Computational Neuroscience

December 2022 (expected)

Email: g.william.chapman.iv@gmail.com

University of Colorado

Boulder, CO

2018

Master of Arts - Cognitive Psychology

Boston, MA

Boston University

Bachelor of Science - Biomedical Engineering

Boston, MA 2012

SKILLS

- Languages: Python, MATLAB, R, Bash, SQL, LATEX
- Frameworks: Scikit Learn, PyTorch, Pandas, Numpy, Slurm, SGE, Git
- General: Machine Learning, Time Series, Project Management, Scientific & Data Communication, Advanced Statistical Analysis, Dynamical Systems, Biomedical Engineering

EXPERIENCE

Boston University

Boston, MA

Graduate Research Fellow

2018 - Present

- o Biological Predictive Coding: Created a novel, biologically inspired, machine learning architecture and learning rule for predicting temporal sequences. Functions above SOTA for both short-term and long-term sequence prediction, with applications for lifelong learning, and generalization.
- Egocentric-Allocentric Transformations: Created a computational model which recieves self-centered sensor and motor information, fusing the information through recurrent hidden layers. Hidden layers create explicit reference-frame transformations, in addition to low-dimensional latent representations.
- Symbolic Predictive Learning: Created a machine-learning model which utilizes predictive coding and dynamic routing (attention) to solve a symbolic reasoning task.

eCortex & University of Colorado

Boulder, CO

Neural Modeler

2016 - 2018

o Electrophysiology & Symbolic Reasoning: Extended existing computational models of working memory to create a model capable of simple symbollic processing, utilizing attentional mechanisms. Designed and ran a corresponding EEG experiment to test model predictions. Created novel causal frequency-time analyses to determine timecourse of functional connectivity.

Center for Systems Neuroscience

Boston, MA

Research Software Engineer

May 2012 - August 2016

- o CMBHOME: Primary contributor for centralized MATLAB-based OOP software for standardized data storage and analysis pipelines of neural and behavioral data across multiple labs.
- o Research: Primary statistical analysis expert for over ten peer-reviewed publications in systems and comutational neuroscience, including time-series analysis, frequentist statistics, generalized linear models, and data exploration.

Boston Medical Center

Boston, MA

Neuroimaging Research Assistant

May 2009 - May 2012

o Alzheimer's Disease: Primary individual for data pipelines and novel analysis of structural MRI and behavioral data, leading to predictive models of clinical Alzheimer's Disease progression.

Publications

- 1. A. S. Alexander, J. C. Tung, G. W. Chapman, A. M. Conner, L. E. Shelley, M. E. Hasselmo, and D. A. Nitz, "Adaptive integration of self-motion and goals in posterior parietal cortex," *Cell Reports*, vol. 38, p. 110504, Mar. 2022
- 2. L. C. Carstensen, A. S. Alexander, G. W. Chapman, A. J. Lee, and M. E. Hasselmo, "Neural responses in retrosplenial cortex associated with environmental alterations," *iScience*, vol. 24, p. 103377, Nov. 2021
- 3. M. E. Hasselmo, A. S. Alexander, A. Hoyland, J. C. Robinson, M. J. Bezaire, G. W. Chapman, A. Saudargiene, L. C. Carstensen, and H. Dannenberg, "The unexplored territory of neural models: Potential guides for exploring the function of metabotropic neuromodulation," *Neuroscience*, p. S0306452220302141, Apr. 2020
- 4. A. S. Alexander, J. C. Robinson, H. Dannenberg, N. R. Kinsky, S. J. Levy, W. Mau, G. W. Chapman, D. W. Sullivan, and M. E. Hasselmo, "Neurophysiological coding of space and time in the hippocampus, entorhinal cortex, and retrosplenial cortex," *Brain and Neuroscience Advances*, vol. 4, p. 239821282097287, Jan. 2020
- 5. A. S. Alexander, L. C. Carstensen, J. R. Hinman, F. Raudies, G. W. Chapman, and M. E. Hasselmo, "Egocentric boundary vector tuning of the retrosplenial cortex," *Science Advances*, July 2019
- 6. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Neuronal representation of environmental boundaries in egocentric coordinates," *Nature Communications*, vol. 10, p. 2772, Dec. 2019
- C. K. Monaghan, G. W. Chapman, and M. E. Hasselmo, "Systemic administration of two different anxiolytic drugs decreases local field potential theta frequency in the medial entorhinal cortex without affecting grid cell firing fields," Neuroscience, vol. 364, pp. 60–70, 2017
- 8. J. R. Hinman, M. P. Brandon, J. R. Climer, G. W. Chapman, and M. E. Hasselmo, "Multiple Running Speed Signals in Medial Entorhinal Cortex," *Neuron*, vol. 91, no. 3, pp. 666–679, 2016
- 9. M. Ferrante, C. F. Shay, Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "Post-Inhibitory Rebound Spikes in Rat Medial Entorhinal Layer II/III Principal Cells: In-Vivo, In-Vitro, and Computational Modeling Characterization," *Cerebral Cortex*, no. March, 2016
- 10. Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "Rebound spiking properties of mouse medial entorhinal cortex neurons in vivo.," *The European journal of neuroscience*, vol. 42, pp. 2974–2984, Jan. 2015
- 11. C. F. Shay, M. Ferrante, G. W. Chapman, and M. E. Hasselmo, "Rebound spiking in layer II medial entorhinal cortex stellate cells: Possible mechanism of grid cell function," *Neurobiology of Learning and Memory*, 2015
- 12. F. Raudies, M. P. Brandon, G. W. Chapman, and M. E. Hasselmo, "Head direction is coded more strongly than movement direction in a population of entorhinal neurons," *Brain Research*, vol. 1621, pp. 355–367, Sept. 2015
- 13. A. L. Jefferson, K. A. Gifford, S. Damon, G. W. Chapman, D. Liu, J. Sparling, V. Dobromyslin, and D. Salat, "Gray & white matter tissue contrast differentiates Mild Cognitive Impairment converters from non-converters," *Brain Imaging and Behavior*, vol. 9, pp. 141–148, June 2015
- K. a. Gifford, D. Liu, S. M. Damon, G. W. Chapman, R. R. Romano, L. R. Samuels, Z. Lu, and A. L. Jefferson, "Subjective Memory Complaint Only Relates to Verbal Episodic Memory Performance in Mild Cognitive Impairment," *Journal of Alzheimer's Disease*, vol. 44, pp. 309–318, Jan. 2015

Professional Service

- Invited reviewer: Neural Networks (2018-present); Neural Information Processing Systems (NeurIPS) (2019-present); International Conference on Learning Representations (ICLR) (2020-present)
- Academic Planning Committee: Graduate Student representative on a small panel of faculty responsible for overseeing and approving changes in undergraduate and graduate degree program requirements. 2018 2019.

- 1. G. W. Chapman and M. E. Hasselmo, "Trajectory prediction in a biologically inspired network with a strong inductive bias," Oct. 2020
- 2. G. W. Chapman and M. E. Hasselmo, "Trajectory prediction in a biologically inspired network," Nov. 2020
- 3. G. W. Chapman, "A model of relational reasoning through selective attention and working memory," Mar. 2019
- 4. L. C. Carstensen, A. Alexander, G. W. Chapman, and M. E. Hasselmo, "Representations of landmarks in the retrosplenial cortex," Oct. 2019
- 5. A. Alexander, L. C. Carstensen, G. W. Chapman, F. Raudies, J. R. Hinman, and M. E. Hasselmo, "Egocentric boundary vector tuning of the retrosplenial cortex," Oct. 2019
- 6. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Neuronal representation of egocentric boundaries in egocentric coordinates," Oct. 2018
- 7. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Egocentric representation of environmental boundaries in the striatum," June 2018
- 8. L. C. Carstensen, A. Alexander, J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Spatial correlates of the retrosplenial cortex during free exploration," Oct. 2018
- 9. A. Alexander, L. C. Carstensen, F. Raudies, G. W. Chapman, J. R. Hinman, and M. E. Hasselmo, "Retrosplenial and entorhinal cortical representations during visually-based triangulation," Oct. 2018
- 10. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Egocentric representation of environmental boundaries in the striatum," Oct. 2017
- 11. J. R. Hinman, G. W. Chapman, and M. E. Hasselmo, "Representation of environmental boundaries within an egocentric reference frame," Oct. 2016
- 12. Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "In Vivo rebound spike characteristics of medial entorhinal cortex cells," Oct. 2015
- 13. C. K. Monaghan, G. W. Chapman, and M. E. Hasselmo, "Medial Septal infusion of a serotonin 1A agonist anxiolytic reduces theta frequency in the medial entorhinal cortex," Oct. 2015
- 14. J. R. Hinman, J. R. Climer, G. W. Chapman, and M. E. Hasselmo, "A novel slow oscillatory neuron in the lateral septum," Oct. 2015
- 15. C. F. Shay, M. Ferrante, G. W. Chapman, and M. E. Hasselmo, "Layer II Medial Entorhinal Cortex Stellate cells in rat display phase specific post inhibitory rebound spiking," Nov. 2014
- 16. M. Ferrante, C. F. Shay, Y. Tsuno, G. W. Chapman, and M. E. Hasselmo, "Modeling Intrinsic and Extrinsic mechanisms in rat entorhinal cortex and hippocampus that may influence grid and place cells," Nov. 2014
- 17. J. R. Climer, R. DiTullio, J. R. Hinman, G. W. Chapman, M. P. Brandon, M. E. Hasselmo, and U. T. Eden, "Addressing Theta rhythmicity in extracellularly recorded neurons in rat and bat," Oct. 2014
- 18. F. Raudies, M. P. Brandon, G. W. Chapman, and M. E. Hasselmo, "Movement Direction is Not Coded by the Firing of Most Entorhinal Cells, but Required by Grid Cell Models," Oct. 2013
- 19. J. R. Hinman, M. P. Brandon, G. W. Chapman, and M. E. Hasselmo, "Speed Modulation of Medial Entorhinal Cortical Neurons During Medial Septal Inactivation," Oct. 2013
- 20. K. A. Gifford, S. Damon, R. R. Romano, G. W. Chapman, and A. L. Jefferson, "Cognitive Complaints are related to memory performance in older adults with Mild Cognitive Impairment," Feb. 2013
- 21. M. Ferrante, C. F. Shay, G. W. Chapman, M. Migliore, N. J. Kopell, H. Eichenbaum, and M. E. Hasselmo, "Modeling Intrinsic and Extrinsic Mechanisms in Rat Entorhinal Cortex and Hippocampus that May Influence firing of grid and place cells," Oct. 2013
- 22. G. W. Chapman, N. W. Schultheiss, M. P. Brandon, and M. E. Hasselmo, "Theta Cycle Skipping Relationships in the Medial Entorhinal Cortex are Robust," Oct. 2013
- 23. A. L. Jefferson, G. W. Chapman, J. Sparling, K. A. Gifford, B. Martin, V. Dobromyslin, and D. Salat, "Semi-automated Method for Quantifying Infarcts in Older Adults with and without Dementia," Feb. 2012
- 24. G. W. Chapman, A. L. Jefferson, K. A. Gifford, J. Sparling, N. Cantwell, R. R. Romano, V. Dobromyslin, and D. Salat, "Grey-White Matter Contrast Ratio Relates to Progression in Mild Cognitive Impairment.," July 2012

- 25. G. W. Chapman, A. Gentile, N. Cantwell, V. Williams, D. Salat, and A. L. Jefferson, "White Matter Integrity in Entorhinal Cortex & Parahippocampal Region is Associated with Memory Performances in Individuals with Mild Cognitive Impairment.," Feb. 2010
- 26. M. Badaracco, K. A. Gifford, A. Gentile, G. W. Chapman, Y. Tripodis, and A. L. Jefferson, "The Relation of Hypertension to Cognition in Observational Studies: A Meta-Analysis," Feb. 2010